C introduction

Pointers

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Contents

RGB

Consider a function that calculates the RGB values of a hex color string:

```
int calcRGB(char hexString[]) {
    ...          /* converting hexString into RGB values */
    return ???;
}
```

- It is not possible to return 3 values.

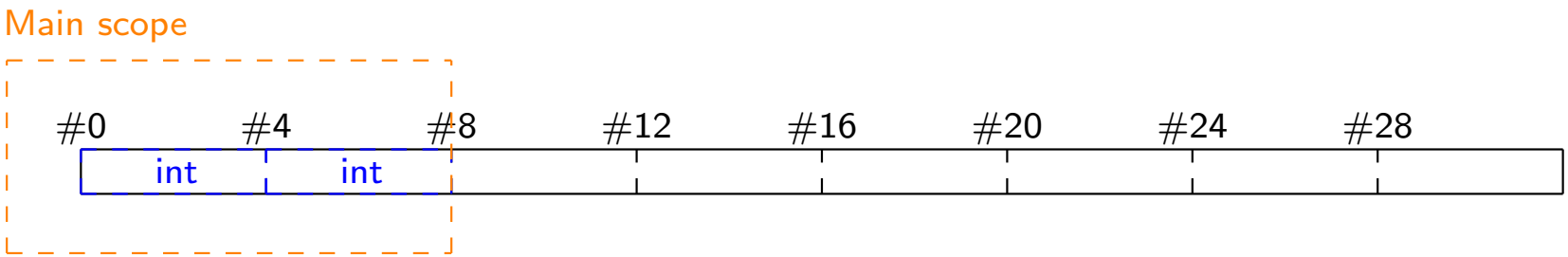
We could write 3 different functions:

```
int calcR(char hexString[]) { ... } /* returns R value */
int calcG(char hexString[]) { ... } /* returns G value */
int calcB(char hexString[]) { ... } /* returns B value */
```

Or we declare the 3 variables before the function call and just tell the function were to put the values.

Memory again

- You have two int variables in your main function.



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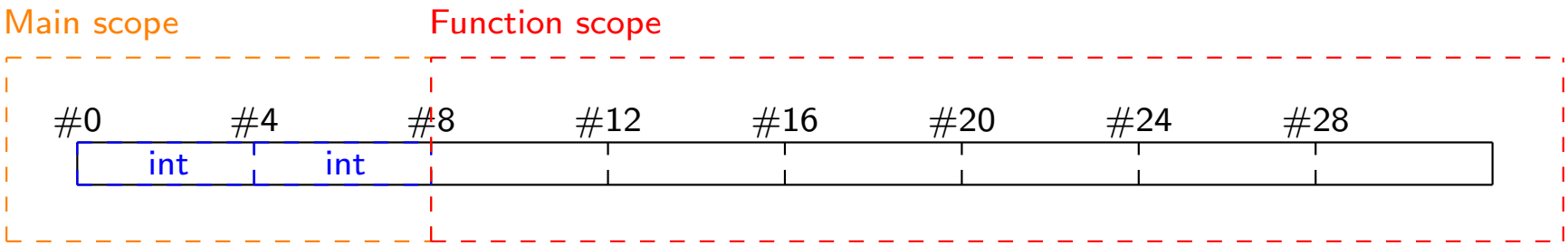
- Now you call a function



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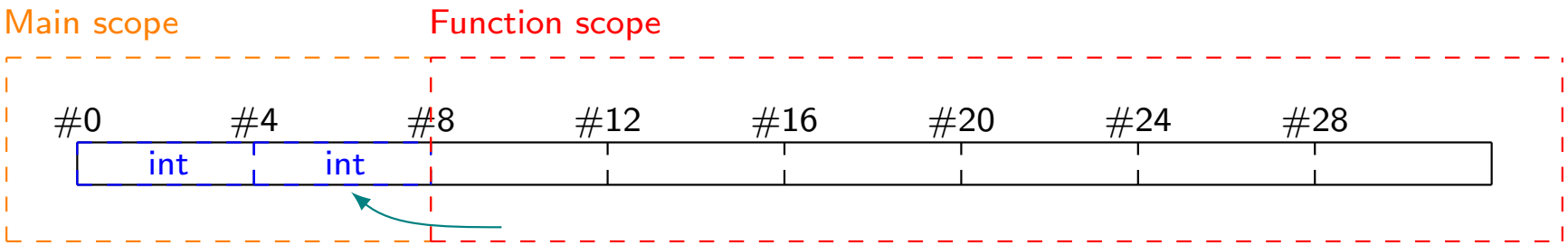

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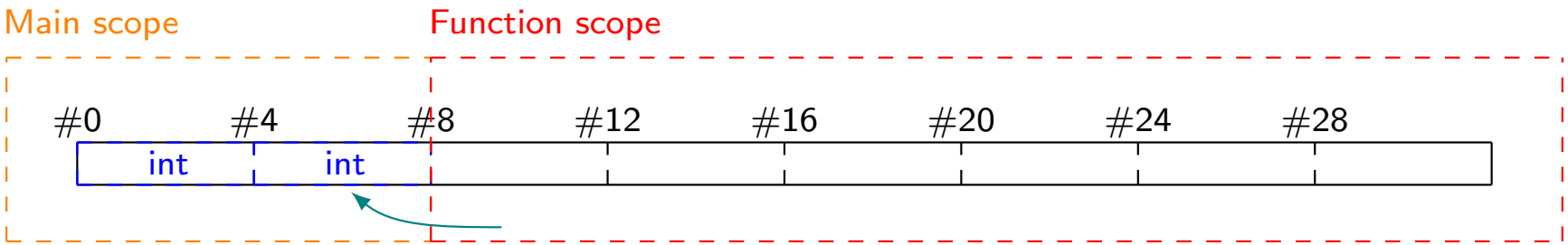

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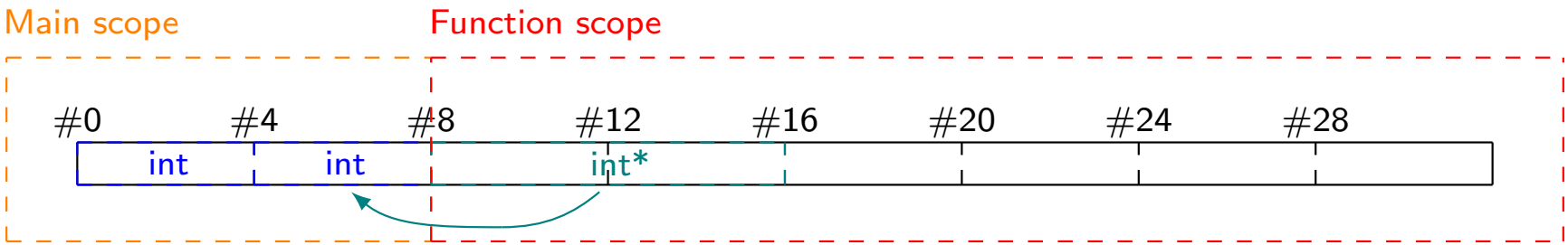

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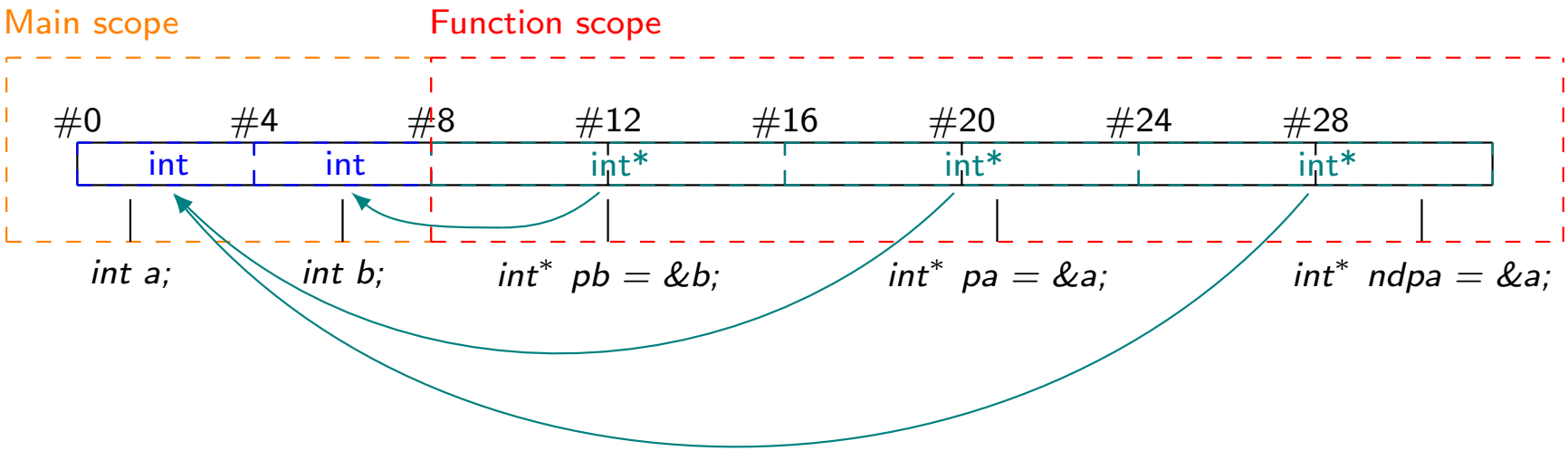


- You'll have to pass the adress of this variable
- This adress is stored in a *pointer* variable
- This method is called *call by reference*

Operators

- To declare a Pointer, use the *dereference operator* *****
- To get the adress of a variable, C comes with the *adress operator* **&**
- To access the variable a pointer points to, dereference it with the *dereference operator* *****

```
int a = 42;
int* pa;      /* declare an int pointer*/
pa = &a;      /* initialize pa as pointer to a */
*pa = 13;     /* change a */
```

incrementing and decrementing

If you want to increment or decrement the variable a pointer points to, you have to use Parentheses.

```
int a = 42;
int* pa = &a;     /* define pa as pointer to a */
(*pa)++;          /* increment a */
(*pa)--;          /* decrement a */
```

If you havent used the parentheses, you in-/decremented the pointer, not the variable it points to. Congratulations, you just invented pointer arithmetic but we'll talk later about that.

Back to RGB

Now we can think of the RGB function as one function, taking the hexString and 3 Pointers:

```
void calcRGB(char hexString[], int* r, int* g, int* b) {
    ...
    *r = calculatedRValue;
    *g = calculatedGValue;
    *b = calculatedBValue;
}
```

Call it with

```
int r, g, b;
calcRGB("ffffff", &r, &g, &b);
```

- You now should understand how scanf works.

Returning pointers

Pointers can be return values, too.

But

```
int* someFunction() {
    int a = 42;
    return &a;
}
```

- Dafuq did just happen?

Calculating circles

- Write a function that takes the radius of a circle and returns the area and the circumference
- **Experts:** Implement the circle as a structure and PI as an enum. But don't take the structure as a parameter.

Calculating circles

- Write a function that takes the radius of a circle and returns the area and the circumference
  - Hint: "returns"
- **Experts:** Implement the circle as a structure and PI as an enum. But don't take the structure as a parameter.

Swap

- Write a function that swaps the values of 2 variables.
- **Experts:** Write a function, that rotates 3 values in a given direction.

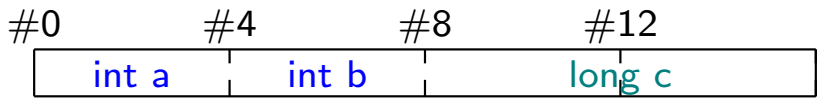
Swap

- Write a function that swaps the values of 2 variables.
  - Hint: Don't forget the buffer variable.
- **Experts:** Write a function, that rotates 3 values in a given direction.

p++

You can in-/decrement a pointer. If you do so, the adress it points to will change.
The adress changes by the size of the pointer type.

```
int a, b;
long c;
int* p = &a;
p++;
p++;
p++;
```



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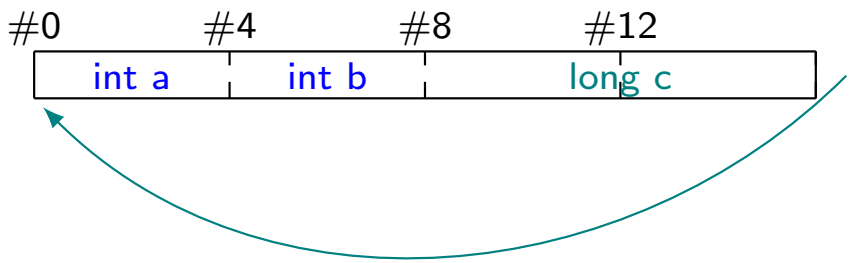

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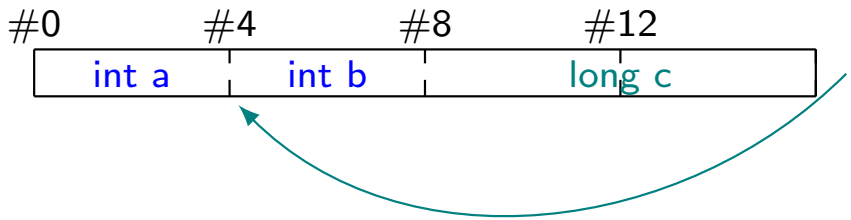

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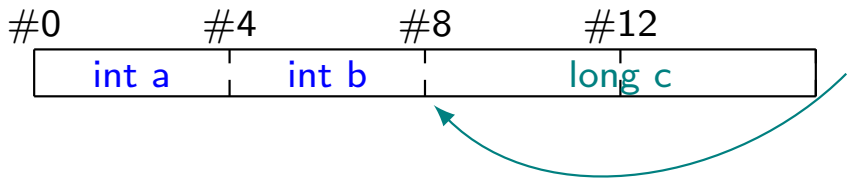

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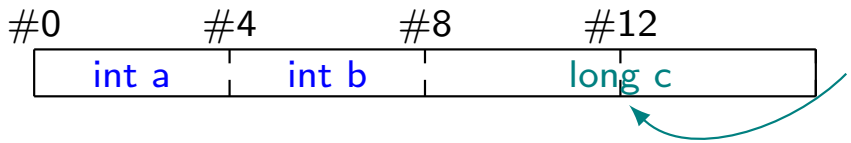

- Since the pointer is of type *int**, the target adress moves only the size of *int*

Pointer and Arrays

The identifier of an array can be considered a pointer.
This means we can consider the index as an offset for the pointer and access array elements trough pointer arithmetic:

```
int leet[4] = {1, 3, 3, 7};
int* pleet = leet;
*(pleet++) = 2;
printf("%d %d\n", *pleet, *(pleet + 2));
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- What is the output?

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- Why?
  - Hint: Wasn't there a difference between $c++$ and $++c$?

argc and **argv**

You can pass strings to the main function by writing them on the command line.

```
$ ./a.out string1 longer_string2
```

- They are stored in *argv*
- *argv* is an array of pointers to the first character of a string
- *argc* is the count of strings you passed

Hello, is it me you're looking for?

- Write a program wich is greeting the name you pass to the main function.
- **Experts:** The Program should write a greeting for each name, that's passed.

Printing strings

- Write a function that prints an input string char by char, using pointer arithmetic.
- **Experts:** Again, fill the output with whitespaces **between** the chars.